

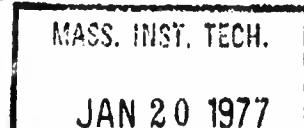
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STRATEGIC DECISION MAKING IN A MANAGEMENT GAME:
AN EXPERIMENTAL STUDY OF OBJECTIVES SETTING
AND CONSISTENCY IN COMPLEX DECISION MAKING

Denis M. S. Lee

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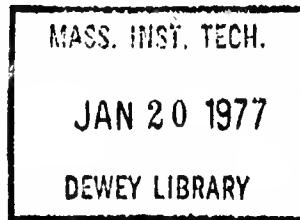


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ACKNOWLEDGMENT. I would like to thank Professor Peter Keen for his moral support and supervision in carrying out this study. Thanks are also due to Professor Lotte Bailyn, Messrs. Makoto Takamiya and Robert Emmerichs for their helpful comments.

A rectangular stamp with a double-line border. The top line contains the text "M.I.T. LIBRARIES". The bottom line contains the date "JAN 21 1977" and the word "RECEIVED" below it.

ABSTRACT

This paper presents an experimental study of the objective formulation and policy aspects of strategic decision making, using business gaming as a research tool. Specifically, the study attempts to explore the objective formulation and consistency issues of group decision making in a dynamic environment. Using multi-dimensional objective functions and a fixed performance scoring rule, certain quantitative indices are obtained for measuring differences in objective settings (focussed vs diverse), as well as the consistency between objectives and performance results.

Results from this study indicate that: i) Teams with focussed objectives tended to have better performance than teams with diverse objectives. The teams with focussed objectives also evolved more top-down decision making organizational structure, but with considerations of fewer alternatives. ii) The successful teams also showed greater consistency between their performance results and the objectives that they had emphasized. iii) However, the requirement for formal planning and policy statements produced no significant differences in team performance although the planning and policy forms were perceived by the game participants as something potentially very useful. Instead, it is found here that proper implementation was probably a more governing factor than the content of planning. iv) No significant differences were observed in the general results obtained from masters student groups and business executive groups.

In summary, the limited evidence that we have obtained in this study seems to suggest that organizational decision making might well be more limited by the issues of objective formulation, coordination and consistency, than by the inability to recognize better opportunities or other alternatives.

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INTRODUCTION

This paper presents an experimental study of the objective formulation and policy aspects of strategic decision making using business gaming as a research vehicle. The research issues of interest here are to investigate how differences in objective settings might affect decision making and performance results, and to obtain some empirical data about how performance results might be related to consistency in the pursuance of established objectives. Given the current lack of adequate definitions in research on policy and planning, and the difficulty of attempting to evaluate process variables as well as measuring outcomes in complex organizational decision making, the essential aim of this paper is to clarify several central concepts and to present results that can be replicable and extensible.

The fundamental view generally assumed in the normative or prescriptive framework of planning and strategic decision making is that the quality of decision making will be improved by conceptualizing the decision making process in more explicit terms, by formulating concrete goals and objectives, by exploring the implications of subjective beliefs and objective data via the use of more formal analytical and evaluative techniques, and by elaborating assumptions and tracking performance. Proponents of formal planning systems thus place the emphasis on examining and extending the 'bounded rationality' (March and Simon, 1958) of executive decision making (e.g. Ackoff 1970, Emery 1967, Reising, 1972). On the other hand, the "intuitionists" argue for more diagnostic skills and judgments rather than for more formal structure in strategic planning.

This latter view of the planning process is held by many writers in political science (e.g. Braybrooke and Lindblom, 1970), as well as by business managers (e.g. Hall, 1973). A major difference between the two views is the relative emphasis on the coordination and consistency issues of decision making. From the organizational decision making point of view, formal planning and policy establishment probably imposes greater constraints and structure in the organizational search of alternatives, facilitates the decision making process, and thus enhances greater consistency in decision making. On the other hand, greater diagnostic skills and more flexible organizational structure (and informational flow) probably enhance the organization's awareness of new opportunities in the environment but run the risk of inconsistencies in decision making and poor organizational coordination.

Before we can hope to settle the pros and cons of this debate in its larger organizational-political context, we need to explore certain basic issues about group decision making in a complex dynamic environment. For example, to what extent are people limited by their cognitive capacity such that it might be better for them to adopt more focussed objectives than more diverse objectives? And, is it as Bowman (1963) has suggested, that managers might not always be consistent in their decisions? And, if so, do inconsistencies in decision making often lead to poor performance results?

In the final analysis, the questions are, of course, empirical ones. Yet there seems to be little chance of answering these questions in the organizational world where managers are typically

evaluated by the results, rather than by the quality of their decisions.

As Chester Barnard (1938) wrote some time ago:

".....Not the least of the difficulties of appraising the executive functions on the relative merits of executives lies in the fact that there is little direct opportunity to observe the essential operation of decision."

Further, immense methodological problems in measuring the quality of the decision process and in factoring out environmental factors obscure the answers to these questions.

Because of these problems, research on managerial decision making and planning has tended to be either field-study oriented with a general lack of specific theory testing; or, alternatively, laboratory based but with usually simple and artificial task involvements. In the present study, we suggest that simulation gaming may provide a valuable middle ground for observation and theory testing. Simulation games, albeit not without their limitations, do provide a dynamic environment and a meaningful task that can generate great enthusiasm among the participants, as well as situations that capture many of the essential characteristics of real world strategic decision making. The use of simulation gaming for research purposes is not new (e.g. Cangelosi & Dill 1962, Cohen et. al. 1964). However, much of the attention so far has only focussed on the operational areas of decision making and with emphasis on performance results alone rather than the quality of decision inputs. In general, the probing of the policy and planning issues (i.e. the integrative aspects) of organizational decision making is still a largely unexplored area.

In this study, we use a general management game to explore how teams set objectives and translate them into strategic and operational decisions. By allowing each competing team certain flexibilities to establish its own relative weightings on a given set of objectives, and by using a fixed multi-dimensional performance scoring rule similar to those of Vance and Gray (1967) and Hand and Sims (1975) we obtain some quantitative measures of 'objective diversity' as well as 'consistency' between objective (rankings) and performance results. With these measurement indices, we are interested in comparing the consequences on organizational decision making and performance results for teams who have set 'focussed' objectives vis-a-vis teams who have set 'diverse' objectives. We are also interested in investigating whether the higher performance teams might exhibit greater consistency between objectives established and performance results.

The data in this study were collected from four separate game offerings, involving two groups of masters students, and two groups of business executives. In two groups (one masters group and one executives group), formal planning and policy statements were also required. This four group experimental design thus also attempts to investigate the possible effects of group characteristics and the imposition of formal planning on team performances.

An additional motivation for this research study lies in viewing it as an educational experiment with management games. From the pedagogical point of view, the objective of general management games (as opposed to functional games) is not just to teach technical skills,

but also to develop the general decision making abilities of the participants. Unfortunately, there often is a lack of emphasis on the integrative aspects of organizational decision making, i.e. the policy and planning issues in business gaming. As Forrester (1961) has criticized, management games often emphasize external, short-term crises, intuition and period-to-period decisions, rather than "the long-range planning of policies and organizations to avoid crisis".

The difficulty on the other hand is, of course, on how to develop methodologies or approaches in analyzing the quality of decision inputs as well as performance results. Much debate has centered around this issue of game performance evaluation (e.g. Meurs & Choffray 1973). Several investigations have found multi-dimensional performance scores to be more reliable measures than single performance scores (e.g. Vance & Gray 1967, Hand & Sims 1975). The present study attempts to relate a multi-dimensional performance scoring rule to the objectives established by the teams. The objective formulation and consistency issues can then be used as a basis for providing feedback to the game participants concerning their organizational decision inputs, i.e. the strategies they chose to adopt, the operational decisions they made, and the planning and policy questions at large. The study itself thus serves as an educational experiment to explore the possibilities of integrating the teaching of planning and policy into business games.

II. Description of the M.I.T. Management Game and Game Administration

A. Game Structure

The M.I.T. Management Game* is a complex corporate computer simulation game that incorporates various functional aspects of management: i.e. marketing, production, and finance. Teams compete in an oligopolistic industrial environment and market one product in two different geographical markets, domestic and foreign. Price, advertising elasticities, and effectiveness of product development vary according to geographical area, consumer income level, seasonal demands, customer loyalty etc. Production is centralized, and shipment of products between geographical areas is permitted with the incurrence of shipping and tariff charges. Lead time is required to increase inventory and to expand production capacities. The financial functions involve cash management, funds transfer to and from foreign operation, debt financing for capital investments, dividend decisions, and issuance or re-purchase of common stocks.

Each team takes over an essentially identical firm at the beginning of the game and runs the firm for eight additional quarters (with heavy seasonal demands in the 4th and the 8th Quarter). Each team inputs a set of decisions that includes product development, marketing, production, capacity expansion, and financing for each quarter and receives a set of five operating reports for the firm from the computer simulation that includes (i) balance sheet statement, (ii) profit and loss statement, (iii) reconciliation of retained earnings, (iv) sources and uses of

*The M.I.T. Management Game was originally designed by David N. Ness

funds statement, (v) inventory reconciliation. In addition each team also receives a common market summary statement that contains noise errors regarding the relative performance of all firms.

B. Performance Scoring Rule

In the administration of the M.I.T. Management Game, we have adopted a composite game performance score incorporating weighted values of several different objectives. The method is similar to those used by Vance and Gray (1967) and Hands and Sims (1975). The multi-dimensional score has several advantages over the use of single criterion (such as profitability only) which would be more subject to chance fluctuation and artificial manipulation. It is also more realistic in that managers of business firms tend to have multiple goals rather than just profit maximization (Panpandreous 1952, Cyert and March 1962). Within the game context, multi-dimensional performance evaluators reduce feedback ambiguities and give a better understanding of the cause and effect relationship between decisions and outcomes in the simulation environment and game dynamics.

The composite game performance score is calculated as follows: At the beginning of the game, a set of objectives (financial measures similar to those used by security analysts) is given to the participants; for example, return on asset (ROA), net earnings (NE), market value (MV), market share (MS), and earnings per share (EPS). The objective measures might also be specified either as average values over several quarters, or as the value at the end period of the game. (Different sets of objectives were used in different game offerings). Each team is then asked to assign a weight to each objective such that the weights add to a total of 20 points, but with a limit on the

maximum and minimum number of points allowed for each objective (e.g. 8 and 2). During the initial two or three periods of the game, teams may also change the weights if they wish. At the end of the game, the teams' performances are ranked according to their relative performances on each objective and points are awarded accordingly. If 6 teams compete during the game, 6 points are awarded to the team ranked first, 5 points to the team ranked second, and so forth. The total score for each team is obtained by multiplying, for each objective, the points awarded based on the rankings times the weighted value assigned by the team, and summing over all objectives. (See Table 1 for sample calculation.) The team with the highest total points wins the game.

Objectives	Ranking Achieved	Points Awarded Based on Rank- ing Achieved	X	Wts. Assigned by Team to Objec- tives	Actual = Points
MV	2nd	5	x	3	= 15
MS	4th	3	x	5	= 15
ROA	1st	6	x	4	= 24
NE	3rd	4	x	8	= 32
Total Actual Score					= 86

Table 1 Sample Calculation of Total Performance Score

C. Rationale for Performance Rule

The rationale for adopting the above performance scoring rule is two fold. On the one hand, we want to have a common basis of performance evaluation for all teams. On the other, we want a scoring procedure which is also flexible enough to induce a 'management by objective' philosophy for the game participants. This (limited) flexibility to decide on their preferences on objectives is important because it renders the evaluation rule more realistic and meaningful. Moreover, it provides an effective focal point for the game participants to center their organizational learning during the early phase of the game competition.

As the set of objectives are not always complementary, (e.g. **stress** on high profit margin will probably put a compressing force upon its market share, or accentuating high dividends may put a squeeze on cash reserve for financing capital investments), it is necessary for the teams to go through some analysis in the first two or three moves of the game. For the purpose of further exposition of the essential nature of the strategic planning and decision making processes involved in this gaming competition, we might conceptualize (somewhat idealistically) the team's decision making process to proceed as follows:

Initially, based on their preferences and learning goals, the team members set up some tentative weightings on the given set of objectives. Thus, where they prefer to run a growth oriented firm, they might assign the highest weights to return on asset (ROA) and market value (MV). Or, if the team members desire to run an aggressive firm and become the product leader, they might stress the weightings on market share (MS)

and net earnings (NE). The team members have to think through the implications of these objectives in order to evolve some sort of overall policy and strategy. In this initial learning phase of the game (first two or three moves), a large part of the team's effort would be spent on understanding the environment, thinking about and estimating the interrelationship between decision variables and performance indices (e.g. how R & D expenditure and advertising affect demand, how price affects sales etc.), as well as on the organizational development aspects of responsibility allocation and coordination. During this initial organizational learning phase, the team might also modify the relative weights on the objectives. The final set of objectives chosen should then provide the direction for the firm and serve as the basis for strategy formulation during the rest of the game competition.

In general, the context of the M.I.T. Management Game has been found to be rich enough to allow different types of strategic planning for the teams; i.e. the different emphases in the set of objectives, and the different market factors they can choose to exploit, (for example, geographic market factor, shoppers vs loyal customers, and the effect of seasonality). The game had been used previously for several years in different teaching programs of the school and has been found to be fairly 'robust' in that game participants have in general regarded the simulation results to be realistic. (Marcotte 1974) Teams have also been able to succeed using a variety of strategies. As a matter of fact, given that the **market** structure is an oligopoly and that there are usually economic slacks in the system (simply by capitalizing on other teams' errors),

there is really no strong reason, a priori, why teams should adopt a specific strategy since they can always try to exploit the current opportunities of the market. The emphasis (and caution) we wish to place here (since it would affect directly the validity of our results in this study) is that our primary interest is on the cognitive aspects of team decision making (i.e. the objective setting and the consistency issues) and how they affect performance results. We want to be reasonably confident that the specific gaming environment chosen is general enough that the teams' performance results are not dominated by any artifact of the simulation gaming structure.

III. Research Design

A. Data Collection

The present study involved observations and data collection over four separate offerings of the M.I.T. Management Game. This allowed for control on two possible extraneous variables--group composition and requirement of formal planning. During two offerings, the game participants were students in the one year accelerated master's program in management at M.I.T., hereafter designated as AGP I and AGP II (for Accelerated Graduate Program I and II). During the other two offerings, the participants were business executives who were enrolled in a 9 week management development program at M.I.T., hereafter designated as SEP I and SEP II (for Senior Executive Program I and II). Each group consisted of 28-35 students and was divided into six teams with 4-6 people on each team. The team assignment procedure was essentially random except that each team must include at least one member who had had some technical background in computers and quantitative analysis.

Principal differences in group characteristics between the AGP students and the Senior Executives may be summarized as follows: The average age for AGP students was about 28, and they all had some full-time work experience. The participants in the SEP's typically hold high management positions in their sponsoring organizations. Their average age was about 45 and all had solid business experience.

The second experimental variable to be controlled is the incorporation of formal planning and policy statements in the management game. In the two groups, AGP and SEP I, only forecasting forms were required from the teams. For the other two groups (AGP II and SEP II), the teams were also required to give explicit policy and planning statements. The Planning and Policy Forms (See Appendix 3) were designed basically to probe the planning assumptions and to induce the teams to formulate more explicit strategy and policy.

An additional question relevant to the present investigation is the perceived usefulness of the Planning and Policy Statements by the participants. Two slightly different questionnaires were given to the two AGP groups at the end of the game. The first questionnaire (Appendix 1) was given to students in AGP I, who did not have the planning and Policy forms during the course of the game. The second questionnaire (Appendix 2) was given to students in AGP II who had used the forms during the game play.

In summary, the data collection in this study is based on a four group experimental design as shown in Table 2. The comparison of AGP groups with SEP groups contrasts the differences that might be due to group characteristics. The requirement on the second groups to have explicit policy formulation and assumption statements contrasts any differences between Groups I and II's stemming from the formal planning requirements.

Table 2. Experimental Design

	Masters Students	Business Executives
Planning with only forecasting required	AGP I	SEP I
Planning with forecasting and explicit policy formulation	AGP II	SEP II

B. Measurement

i) Index of diversity in objective formulation

As explained above, the competing teams were allowed to set their own relative weights on a given set of objectives. For the purpose of analysis, we will define a team that assigned the maximum allowable weights on some objectives and minimum weights on the others as having adopted the 'most focussed' objectives; or conversely, a team that chose to spread out the weights equally over all objectives will be defined as having adopted the 'most diverse' objectives. An index of objective diversity (d) is then calculated as follows: First, rank order the weights on objectives. Then, take the absolute differences (pairwise) between the weights assigned to each objective and weights that would be assigned to each corresponding objective on a 'most focussed' basis. Sum these differences over all objectives. The number is then divided (normalized) by the sum of differences between the 'most focussed' and the 'most diverse' objectives.

As an example, consider a team that has assigned the following weights to a set of objectives: MV=6, ROA=2, MS=4, EPS=5, NI=3; d is computed to equal .5 as shown in Table 3. It should be noted that in general, d has a range of values from 0 to 1, with $d=0$ for the teams having the 'most focussed' objectives and $d=1$ for the teams having the 'most diverse' objectives.

Objectives	Actual Weights Assigned	1	2	3	Diff- erence 1 - 2	Diff- erence 2 - 3
		Most focussed Weights Assignment	Most Diverse Wt. Assignment			
MV	6	8	4	2	2	4
EPS	5	6	4	1	1	2
MS	4	2	4	2	2	2
NI	3	2	4	1	1	2
ROA	2	2	4	0	0	2
				Total=	Total=	
				6	12	

$$\text{Index of Objective Diversity} = 6 / 12 = .5$$

Table 3. Sample Calculation of Index of Objective Diversity

ii) Index of consistency between performance results and objectives

Another measure of interest in this study is the consistency between a team's performance results and the objectives set. If a team places the heaviest weight on market share (MS), the results would be consistent if the team also achieves the best (relative) results in MS and similarly for the other objectives as well. Thus, a measure of consistency between performance results and objectives can be obtained by considering their rank order correlation. The index of consistency (c) is defined here by using the Kendall's Tau rank order correlation coefficient between the two variables. This index has a value ranging from -1 to 1, with the value 1 implying perfect consistency, -1 implying perfect inconsistency, and 0 implying no correlation.

iii) Alternative Measure of Performance

In this study, the major dependent variable of interest is performance as defined by the multi-dimensional scoring rule. In order to verify that any statistically significant results obtained would not be due to possible biases introduced by this rank ordered and weighted scoring rule, we need to check the results with a different and more 'objective' performance scoring rule. Here, a second measure of team performance may be defined by considering the actual numeric (instead of the rank ordered) performance results for the objectives. To derive a simple composite score, the numeric performance results for each objective can be first normalized by comparing against the results obtained for all teams; i.e. by subtracting the group mean and then dividing by the standard deviation. The normalized scores are then averaged over all

objectives to obtain the composite score. Thus, for example, if a team had average performance on each objective, it would receive a score of zero. We will define this performance measure as the 'objective performance score' since it is the most neutral way of scoring using the set of given objectives, (i.e. it disregards the teams' preferences on objectives but weights everything equally.)

IV. Results

Although the teams were allowed to change the weights on objectives during the initial moves of the game, the data obtained from the four groups show no specific pattern of changes in the way teams reset the weightings (e.g. there was no indication that the weightings became more focussed or diverse as objectives were changed). Nor was there any specific pattern as to how the teams within a group might favor the same objectives. In two groups, AGP I and SEP II, different teams within each group placed emphasis on different objectives, following a more or less random distribution. In one group, i.e. AGP II, the majority of teams tended to emphasize two objectives, ROA and NI. In general, no extraneous circumstances were found that might bias the results obtained, as summarized by Table 4. The high correlation found between the actual performance score and the objective score ($r_{ao} = 0.92$) also checks the performance scoring rule used in this study.

Table 4 - Summary of Results

		Index of Diversity (d)	Index of Consistency (c)	Actual Performance Score (a)	Objective Performance Score (o)
A G P I	Team 1	.5	0.12	55	-0.17
	" 2	.5	0.12	46	-0.98
	" 3	.5	0.44	96	0.45
	" 4	0	0.13	82	0.19
	" 5	.17	0.77	110	0.88
	" 6	.33	0.59	70	<u>-0.48</u>
S E P I	Team 1	0	0.0	70	0.08
	" 2	.17	0.18	54	-0.60
	" 3	.17	0.91	88	0.15
	" 4	.5	0.55	65	-0.55
	" 5	.67	0.40	83	0.16
	" 6	.33	0.55	100	0.79
A G P II	Team 1	.67	-0.22	42	-0.58
	" 2	.67	-0.67	48	-0.57
	" 3	.67	0.0	70	-0.08
	" 4	0	0.87	110	0.62
	" 5	.33	0.40	69	0.02
	" 6	.33	0.71	89	0.59
S E P II	Team 1	.33	0.18	52	-0.44
	" 2	.5	0.24	52	-0.45
	" 3	.33	0.80	83	-0.21
	" 4	.17	0.18	104	0.68
	" 5	.67	0.40	79	0.15
	" 6	.67	-0.80	76	<u>0.22</u>

Range of Possible Values 0 - 1 -1 - +1 20 - 120 -

Table 4 Summary of Results (Continue)

<u>Variables</u>	<u>Pearson Correlation</u>	<u>Significance</u>
Actual Performance Score with Objective Performance Score: r_{ao}	0.92	< .01
Actual Performance Score with Index of Diversity r_{ad}	-0.45	< .015
Actual Performance Score with Index of Consistency r_{ac}	0.52	< .01
Index of Diversity with Index of Consistency r_{dc}	-0.54	< .01

Partial Correlations:

$$r_{ad.c} = -.40$$

$$r_{ac.d} = .37$$

A. Focussed vs Diverse Modes of Objective Setting

The results in Table 4 show that, in general, the teams that have adopted more focussed objectives tended to have better performance results. Specifically, there is a significant negative correlation between the index of objective diversity and performance score ($r_{ad} = -0.45, p < .015$)

Observation of team decision making processes and analysis of their performances, as well as information obtained from the teams' orally presented self-analysis at the end of each game indicate that teams with focussed objectives tended to evolve different decision making styles from teams with diverse objectives. The teams that had focussed objectives tended to employ a more centralized, top-down, policy oriented decision making structure. In contrast, the teams with diverse objectives tended to employ a bottom-up, functionally oriented decision making structure. Many of the latter teams' period-to-period operational decisions were dominated by the opinions of different functional experts within the teams (e.g. the person responsible for marketing or forecasting) and apparently often without much scrutiny of the teams' overall decision making objectives. In general, it appears that the adoption of focussed objectives facilitated the strategic management process for the teams by imposing greater policy constraints, but also led to considerations of fewer alternatives; i.e. when decisions had to be made, some options were readily excluded because they were deemed to be not in line with the teams' objectives and strategy. On the other hand, many of the other

teams that had established diverse objectives never succeeded in zeroing in on any sort of clear cut strategy. The significant correlation found between objective setting and performance thus suggests that the teams which had adopted more focussed objectives were better able to achieve their operational goals and desired performance results via the evolution of more top-down policy oriented decision making structure; whereas the teams which had adopted more diverse objectives were more apt to shift strategies but often failed to achieve their desired performance results.

B. Consistency between Objectives and Performance Results

The results from Table 4 show a significant positive correlation between performance and the index of consistency ($r_{ac} = 0.52$, $p < .01$). It should be noted here that the index of consistency, unlike the measure on objective diversity (which was established at the initial part of each game competition), is a posterior measure; i.e. it does not measure directly whether a team might have been consistent or not in the actual pursuit of established objectives during the course of the game. Rather, the easier question for statistical inference here is that: are teams that do well in the game competition also more consistent between their objectives and results (and the converse relationship for teams that had poor performances)? The evidence obtained here remains significant if we had used the objective performance score instead of the actual performance score ($r_{oc} = .33$, $p < .06$).

The statistical evidence is also supported by observations during the games, as well as by questionnaire responses from the game participants. In general, the game participants did perceive inconsistency in decision making as a key factor that led to poor performance. As measured by the returned questionnaires from the two AGP

groups (Appendix I & II). 75% of AGPI and 88% of AGP II agreed that inconsistency was a key factor affecting performance. (See Table 6 for a summary of the two questionnaire responses).

In the teams' oral presentations at the end of the games, the participants often readily acknowledged certain inconsistencies in their decision making. At other times, the inconsistency issue was more subtle. Obviously, they always thought that they were being consistent at the time of the decisions, but the difference was in the analysis performed (or the absence thereof). Teams typically created different future scenarios in planning. What was often missing, however, was an assessment of the probability of such scenarios occurring as well as an estimate of the cost and benefits of each scenarios. Instead, the emotional feeling that something might occur often overshadowed the analysis of decisions and their consistency with expressed policy. It appears that it was often in this respect that the teams with focussed objectives and policy driven decision making organizational structure succeeded in having a large picture and a closer scrutiny of the strategic decision making process.

C. Individual Contribution and Interaction Effects of Objective Setting and Consistency on Performance

The above results show that both objective diversity and consistency are correlated with performance. In addition, we also found a significant correlation between objective diversity and consistency. Thus, it is worthwhile to examine further the individual contribution effects of objective diversity and consistency on performance. The partial correlation between actual performance and objective diversiveness, controlling for consistency (i.e. $r_{ad.c}$) equals -0.40; and the partial

correlation between actual performance and consistency, controlling for objective diversity (i.e. $r_{ac.d}$) is computed to be 0.30. Thus, it appears that both objective diversity and consistency have a similar relationship with performance. A two-way analysis of mean team performance score by the two factors of objective setting and consistency, as shown in Table 5, also indicates the two factors contribute about equally towards performance and shows no evidence of interaction effect.

Table 5. Mean Performance Scores of Teams by
Two-Way Comparison of Objective
Diversity and Consistency

	High Consistency $C \geq .2$	Low Consistency $C < .2$	
High Focus (Low Diversity) (d = 0,1,2)	Mean Performance Score = 89.88 $n_{11} = 8$	Mean Performance Score = 72.4 $n_{12} = 5$	Mean = 83.15 $n_{1.} = 13$
Low Focus (High Diversity) (d = 3,4)	Mean Performance Score = 74.0 $n_{21} = 4$	Mean Performance Score = 59.43 $n_{22} = 7$	Mean = 64.73 $n_{2.} = 11$
	Mean = 84.58 $n_{.1} = 12$	Mean = 64.83 $n_{.2} = 12$	

D. Effect of Group Characteristics and the Requirement of Formal Planning and Policy Formulation on Game Performance

In the present study, we are also interested in investigating whether the requirement for formal planning and policy statements from game participants made any differences in team performances, and whether group characteristics might have entered as an intervening variable. From the results shown in Table 4, we find no noticeable differences in the general patterns of objective setting and consistency measures between the AGP students and the SEP business executives. Nor could we find the requirement for formal planning and policy statements to lead to more focussed objectives or greater consistency. However, in order to make valid comparisons between overall team performances in different groups, we cannot use either the actual performance score or the objective score since they both measure relative performance within each group. A more meaningful cross-group comparison of performance would be in terms of actual game performance measures such as sales, net earnings and market value, as shown in Table 7. But, again, the data failed to show any significant differences in these performance factors for the four groups.

The above finding appears to be somewhat contrary to what might be expected in light of the other results, i.e. explicit planning and policy statements might be expected to lead to better focus on goals and greater consistency in decision making, and thus better performance as well. One relevant question we can raise first is the perceived usefulness of the Planning and Policy Forms by the game participants.

These data were obtained via questionnaires as well as through informal discussions with game participants in groups AGP I (who did not have the forms during their game) and AGP II (who used the forms). The questionnaires and responses are shown in Appendix 1 & 2. The results from these returns are summarized in Table 6. The data show that while both a significant majority of people in both groups (88% in AGP I and 62% in AGP II) indicate that they would, (if given the option), recommend their team to use the forms in spite of the time and effort required (a significant 'cost' in terms of the compressed time allowance between game decisions), there is also the noticeable drop in enthusiasm about the Planning Forms from AGP I to AGP II. In addition, while 84% of the people in AGP I felt that the use of such forms would lead to better planning and performance, a significantly lower percentage of people (54%) in AGP II thought they probably did.

The explanation for this difference in enthusiasm was found in the comments that many AGP II participants appended in their questionnaires as well as from informal discussions with the students. Many participants in this group viewed the forms as bureaucratic red-tape rather than as something that would serve a decision support purpose (e.g. "just another form to fill out for the game administrators"). Thus, while most of the participants agree in retrospect that the forms could have been very useful potentially as a basis of group discussion on policy, strategy and planning, many did not find them useful during the game. And, given that planning and policy formulation requirements probably did not achieve their intended organizational decision making support purpose, the lack of significant results on performance was not surprising.

Table 6 Summary of (Postgame) Questionnaire Responses on Desirability and Effect of Formal Planning

Question	Group	Response		
		Agree	Neutral	Disagree
Planning is better than diagnostic decision Making	AGP I	80%	0%	20%
	AGP II	81%	8%	11%
Inconsistencies is a key factor that led to poor performances	AGP I	75%	25%	0%
	AGP II	88%	4%	8%
Would recommend own team to use the planning forms	AGP I	88%	8%	4%
	AGP II	62%	19%	19%
Believe forms would lead to better planning & performances	AGP I	84%	12%	4%
	AGP II	54%	20%	27%

AGP I (N=25): Did not have the planning forms during the game

AGP II (N=26): Planning forms were required in the game

Table 7. Cross Group Comparison of Game Performance Results

A. AGP I vs AGP II

AGP I (Without Formal Planning Requirement)

<u>Factor (Units)</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>Total</u>
Avg. Promotional + R & D Expenses (\$10 ³)	597	603	611	673	681	627	3792
Avg. Sales-Domestic (10 ³ Units)	551	668	432	540	562	780	3533
Avg. Sales-Foreign (10 ³ Units)	134	209	130	170	190	289	1122
Avg. Earnings (\$10 ³)	556	973	629	719	740	1274	4891
Avg. Mkt. Value (\$10 ⁶)	17.3	19	19.8	20.9	20.8	22.3	-----

AGP II (With Requirement of Formal Planning)

<u>Factor (Units)</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>Total</u>
Avg. Promotional + R & D Expenses (\$10 ³)	654	633	718	888	1048	1162	11573
Avg. Sales-Domestic (10 ³ Units)	534	613	406	484	488	732	3257
Avg. Sales-Foreign (10 ³ Units)	156	166	144	173	165	268	1072
Avg. Earnings (\$10 ³)	599	920	765	739	747	1329	5099
Avg. Mkt. Value (\$10 ⁶)	19.3	21.1	32.9	51	79.6	99.6	-----

Table 7 (Continue)

B. SEP I vs SEP II

SEP I (Without Formal Planning Requirement)

<u>Factor (Units)</u>	<u>Quarter</u>						<u>Total</u>
	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	
Avg. Promotional + R & D Expenses (\$10 ³)	633.3	705.8	746	812	923	1,026	4,846.1
Avg. Sales-Domestic(10 ³ Units)	559.4	649	528.8	574.2	626.6	851.7	3,789.7
Avg. Sales-Foreign (10 ³ Units)	151.7	223.5	173.3	183.5	210.48	313	1,255.5
Avg. Earnings (\$10 ³)	574	884	673.7	736	813	1,475	5,155.7
Avg. Mkt. Value (\$10 ⁶)	17.5	18.2	20.3	23.4	27.6	42.6	-----

SEP II (With Requirement of Formal Planning)

<u>Factor (Units)</u>	<u>Quarter</u>						<u>Total</u>
	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	
Avg. Promotional + R & D Expenses (\$10 ³)	536	643	698	732	791	692	4092
Avg. Sales-Domestic(10 ³ Units)	518	705	540	531	531	830	3655
Avg. Sales-Foreign (10 ³ Units)	146	237	180	189	205	330	1287
Avg. Earnings (\$10 ³)	525	867	612	720	732	1406	4862
Avg. Mkt. Value (\$10 ⁶)	17.7	17.7	18.8	22.1	28.4	39.7	-----

V. Conclusion

In this study, we suggested the use of multi-dimensional performance scoring rule as a potentially effective mechanism for providing feedback to game participants about the goal formulation, policy and planning aspects of group decision making. By evaluating each team's decision inputs from this perspective, more insight can be gained about the dynamics and causal effects of organizational decision making, and thus making the gaming exercise a more meaningful educational experience for the participants. The use of the multi-dimensional performance score in this study was checked by its high correlation with another objective performance measure.

The major results obtained in this study indicate that the role of objectives and consistencies in group decision making were significant factors that affect performance. Specifically, teams with more focussed objectives tended to have better performances in the gaming competitions. It was observed that the adoption of more focussed objectives by a team had certain implications for the decision making process that evolved; i.e. they tended to lead to more centralized, policy-driven, top-down organizational structure which facilitated the group decision making process, but generally with considerations of fewer alternatives. In addition, the successful teams in the gaming competitions also showed greater consistencies between their objectives and performance results. Questionnaire responses from two groups also indicated that a great majority of game participants perceived inconsistency to be a key factor affecting game performance.

No differences were found in the results for the masters student groups and the business executive groups. There was also no evidence of any improvements in the performance results or observable

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Appendix 1: Questionnaire for AGP I Game Participants and Respondents (N=25)

MEMO TO: AGP Students
FROM: Denis Lee
DATE: May 1, 1975

I am in the process of doing a research study on strategic decision making using the MIT Management Game. (A draft of my paper will be available for anyone who might be interested). I hope to get your assistance in filling out the following short questionnaire:

Please answer the following Questions -

1) The formulation of longer term strategy, based on the team's goals and objectives and their implications, would lead to better performances than the use of more diagnostic, short-term, opportunities oriented decision making.

0 5 0 14 6
strongly
disagree disagree neutral agree strongly
disagree agree agree

2) Inconsistencies in decision making is a key factor that leads to poor performances.

0 0 6 15 3 1
strongly
disagree disagree neutral agree strongly
disagree agree No Response

Please read the attached Planning and Policy Statement which is designed to use with the Game, and then answer the following two questions -

3) In general, our team (Team#) did/did not (please cross out one) follow an explicit strategy and policy formulation similar to the detail suggested here.

did	---	10
did not	-----	13
no response	-----	2

4) I feel that the use of such explicit strategy and policy formulation would lead to better performance for our team.

<u>0</u> strongly disagree	<u>1</u> disagree	<u>3</u> neutral	<u>12</u> agree	<u>9</u> strongly agree
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5) Given the extra time and effort required in filling out the forms and discussion amongst team members, I don't feel our team would want to use it.

<u>2</u> strongly disagree	<u>12</u> disagree	<u>7</u> neutral	<u>3</u> agree	<u>0</u> strongly agree	<u>1</u> no response
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6) I would recommend my team to use such a form.

<u>0</u> strongly disagree	<u>1</u> disagree	<u>2</u> neutral	<u>17</u> agree	<u>5</u> strongly agree
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Name: _____ (Optional)

Thank you,

Please return completed questionnaire to my mai^l folder.

Appendix 2: Questionnaire for AGP II Game Participants (N=26)

MEMO TO: AGP STUDENTS
FROM: DENIS LEE
DATE: 8-22-75

I am in the process of doing a research study on strategic decision making using the MIT Management Game. (A draft of my paper will be available later for anyone who might be interested). I hope to get your assistance in filling out the following short questionnaire:

1) The formulation of longer term strategy, based on the team's goals and objectives and their implications, would lead to better performances than the use of more diagnostic, short-term, opportunities oriented toward decision making.

1 2 2 10 11
STRONGLY DISAGREE DISAGREE NEUTRAL AGREE STRONGLY AGREE

2) Inconsistencies in decision making is a key factor that leads to poor performances.

0 2 1 12 11
STRONGLY DISAGREE DISAGREE NEUTRAL AGREE STRONGLY AGREE

I would also like to get your opinion specifically about the usefulness of the Planning & Policy Statement in aiding your team's decision making.

3) I feel that the use of such explicit strategy and policy formulation did lead to better planning and probably higher performance as well.

2 5 5 8 6
STRONGLY DISAGREE DISAGREE NEUTRAL AGREE STRONGLY AGREE

4) Given the time and effort required in filling out the forms and discussion amongst team members, I would not recommend my team use them, given the option.

9 7 5 5 0
STRONGLY DISAGREE DISAGREE NEUTRAL AGREE STRONGLY AGREE

Appendix 3. Planning and Policy Forms

The Process of Strategic Planning

1. The first step in planning is, of course, setting up your priorities on long-term objectives. This involves assigning relative weights to four measures of performance (see Firm Goal Questionnaire):

market share

market value (stock price x shares outstanding)

return on assets

net earnings

The weights you assign obviously determine your overall strategy in the Game. You are required to fill out the Firm Goal Questionnaire before the game begins. However, you will have a chance to revise this after the first two moves.

2. Having specified your long-term objectives, you need to identify how your own decisions, environmental factors and competitive actions all influence the performance indices (and hence, your long-term objectives). The planner's job thus may be viewed as building and testing hypotheses about two sets of relationships:

a) Environmental factors, such as Industry demand

b) Functional relationships between decisions and environmental variables

A. Environmental Variables

The main environmental factor to be analyzed and explained is, of course, Industry demand. You will need to build a conceptual model of demand in the form:

Demand = f (GNP, industry advertising, industry pricing...R&D)

f(x,y) means is a function of x and y

REGR, the time-shared regression package may be of immense help here. However, well before you use REGR you need to build your mental model. One of the worst mistakes that can be made in using multivariate analytical techniques like regression is to use it for "data-dredging", to randomly try combinations of variables in the hope that they will somehow give you "the" answer. You must have a coherent theory of the market: regression, in a way, merely tests your theory and helps you adjust it.

Appendix 3 (Continue)

B. Functional Relationships

A few, by no means all, examples are given below of functional relationships. These relationships try to link decisions (controllable) with environmental factors (non-controllable but forecastable) to enable you to maximize a performance objective. For example (again the illustration is only hypothetical):

Market share = f (Unit sales, total demand)

Unit sales = f (Price relative to competitors, Promotion, R & D, available inventory, brand loyalty)

Demand is non-controllable but forecastable; the planner needs to develop an estimate of the relative impact on sales of a price cut or increase, advertising level, etc.

4. Of course, the set of interacting relationships in the Game are very complex and it is unlikely you can accurately identify them all. Moreover, the payoff from doing so might be small. In your planning, you essentially need to develop a general insight into the main dynamics of the Game and a selective analysis in more detail of key relationships. In addition, you need to coordinate and integrate the various components of your planning, obviously there may be occasions when your marketing and production plans are mutually incompatible. As a means to helping you in this coordination and to ensure that you review your short-term decisions in relation to your long-term objectives, you will be required to submit a Policy Statement every two moves (Q14, 16, and 18). In addition, you should submit forecasts and a brief review of your current activities with each move. These forms are shown in the next pages.

Appendix 3 (Continue)

POLICY STATEMENT
[Due Q14, Q16, & Q18]

Quarter _____
Team _____

Part A

We have assigned the following weights for our long-term objectives:

- _____ Market value Q19
- _____ Market share Q19
- _____ Average earnings Q14-Q19
- _____ Average return of assets Q14-Q19

We have considered the performance indices that are central to achieving these objectives to be:

- Market Value _____
- Market Share _____
- Earnings _____
- Return on Assets _____

Our general strategy will be:

How would you evaluate your performance in relation to your strategy over the last two moves?

Appendix 3 (Continue)

Part B

1. Describe any models or general equations you have developed for forecasting.

2. Describe your assumptions and policies in the following areas:

a) Pricing

assumptions about importance/impact of pricing:

policy:

b) Promotion

assumptions about impact of promotional effects:

policy:

c) R & D

assumptions about impact of R & D:

policy:

d) Summary of overall Marketing Strategy

Appendix 3 (Continue)

Part B (continued)

e) Summary of Production and Inventory Strategy

f) Summary of Labor and Plant Expansion Strategy

g) Summary of Cash Management Strategy

h) Summary of Stock Strategy

i) Summary of Overall Financial Strategy

Date Due

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